

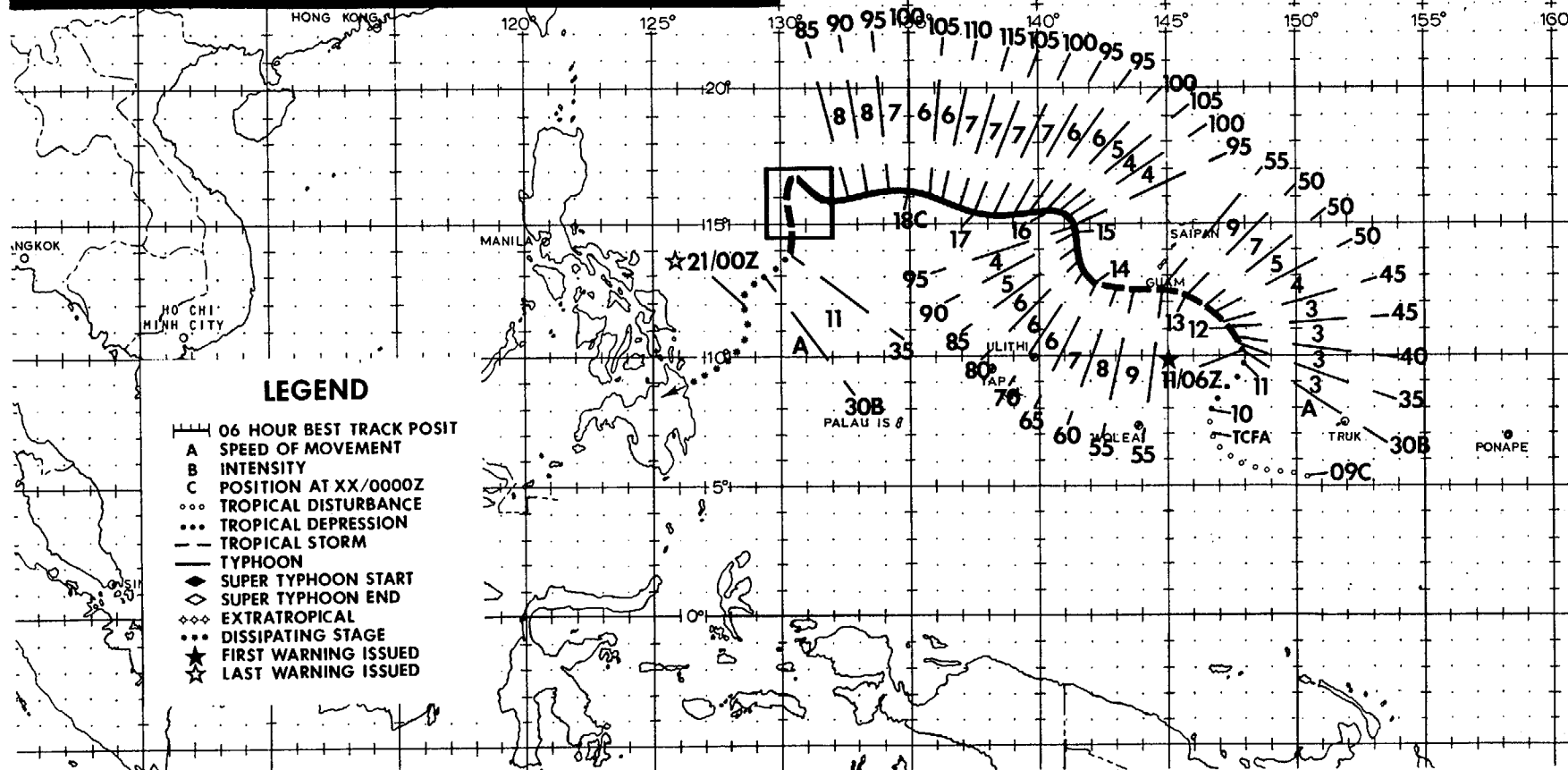
## TYPHOON KIT

BEST TRACK TC-28

11 DEC - 21 DEC 1981

MAX SFC WIND 115KTS

MINIMUM SLP 924 MBS



Typhoon Kit was unlike most December tropical cyclones in that it had a prolonged lifetime (40 warnings) and attained a maximum intensity well over 100 kt (51 m/sec). Kit's origin was not uncommon for late season tropical cyclones; during early December, the winter near-equatorial trough had established itself south of 10N as the tradewind easterlies merged with northeasterlies from higher latitudes placing the westernmost extension of the trough in the Philippine Sea. Eastward, lighter winds were observed turning cyclonically within the trough and, as early as 4 December, surface analyses suggested a possible low-level center developing southwest of Ponape (WMO 91348). On 7 December, the Significant Tropical Weather Advisory (ABEH PGTW) discussed an area of disturbed weather southwest of Truk Atoll (WMO 91334), but the associated convective pattern and observational data were not conducive to further action for another two days. At 091930Z, based primarily upon the improved

convective organization as revealed on satellite imagery, the first of three Tropical Cyclone Formation Alerts was issued.

On 10 December, a reconnaissance aircraft conducted an investigation in the western periphery of the trough and the opportunity to close off a circulation center was lost. Satellite data (Fig. 3-28-1) and subsequent aircraft reports suggest that the center existed just east of the area investigated. At 101845Z, a formation alert was reissued for the same general area. Later satellite data and aircraft observations indicated that the center had moved northward, thus at 102325Z the third formation alert was issued. Reconnaissance aircraft finally closed off a circulation center near 10N 148E (110348Z) and at 110443Z, the first warning on Tropical Depression 28 was issued (Fig. 3-28-2). The 111200Z warning upgraded TD-28 to Tropical Storm Kit based on aircraft data (110723Z) which indicated tropical storm strength winds in all four quadrants.



Figure 3-28-1. Active convection surrounds a developing low-level center. During this period, a reconnaissance aircraft investigated the westernmost area but did not reach the convective center as depicted on satellite imagery, 100443Z December. (NOAA 7 visual imagery)

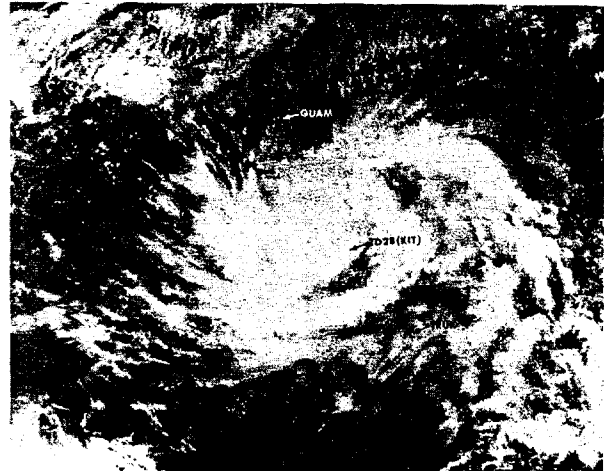


Figure 3-28-2. Tropical Depression 28 at the time of the first warning. Note the extended cirrus clouds on the western side. Strong upper-level easterlies would continue to exert considerable pressure on TD-28 (Kit) for another 2 1/2 days. Thus, most of the associated convection was displaced in the western two-thirds of the circulation, 110430Z December. (NOAA 7 visual imagery)

The initial warnings indicated that Kit would track slowly north-northwestward until approaching 12N then, as the system interacted with mid- and low-level easterlies, a more westward track was anticipated taking Kit just south of Guam. Although Kit maintained the forecast track, the speed of movement remained at or below 4 kt (7 km/hr) for the first 30 hours of warning status. Having not fully anticipated the exceptionally prolonged slow speed, all reconnaissance aircraft were evacuated to Clark AB after the 120849Z fix to avoid the expected destructive winds on Guam. As a result, warnings issued during the ensuing 25 hours were based entirely on satellite data. However, during this stage of development, Kit was not well-aligned in the vertical and the main convective mass was displaced to the west of the low-level center. Thus, nighttime infrared imagery had to be scrutinized for subtle details which could help locate the low-level center. Figure 3-28-3 is typical of the

nighttime infrared imagery used to fix Kit during this period. Thanks to the efforts of satellite operations personnel from Detachment 1, 1WW, Nimitz Hill, Guam, the fixes received during this period were highly accurate (never more than 15 nm (28 km) from the final best track) and the warnings issued from this data followed Kit closely as she finally accelerated on a west-northwest track south of Guam.

Just after Kit passed south of Guam, reconnaissance aircraft indicated a central pressure of 992 mbs which revealed that no appreciable development had taken place during the 25 hour period between aircraft penetrations. However, during the two days that followed, Kit intensified and reached a peak of 105 kt (54 m/sec) before weakening slightly to 95 kt (49 m/sec) at 160600Z. Figure 3-28-4 shows Kit early in this intensification period. During this period of

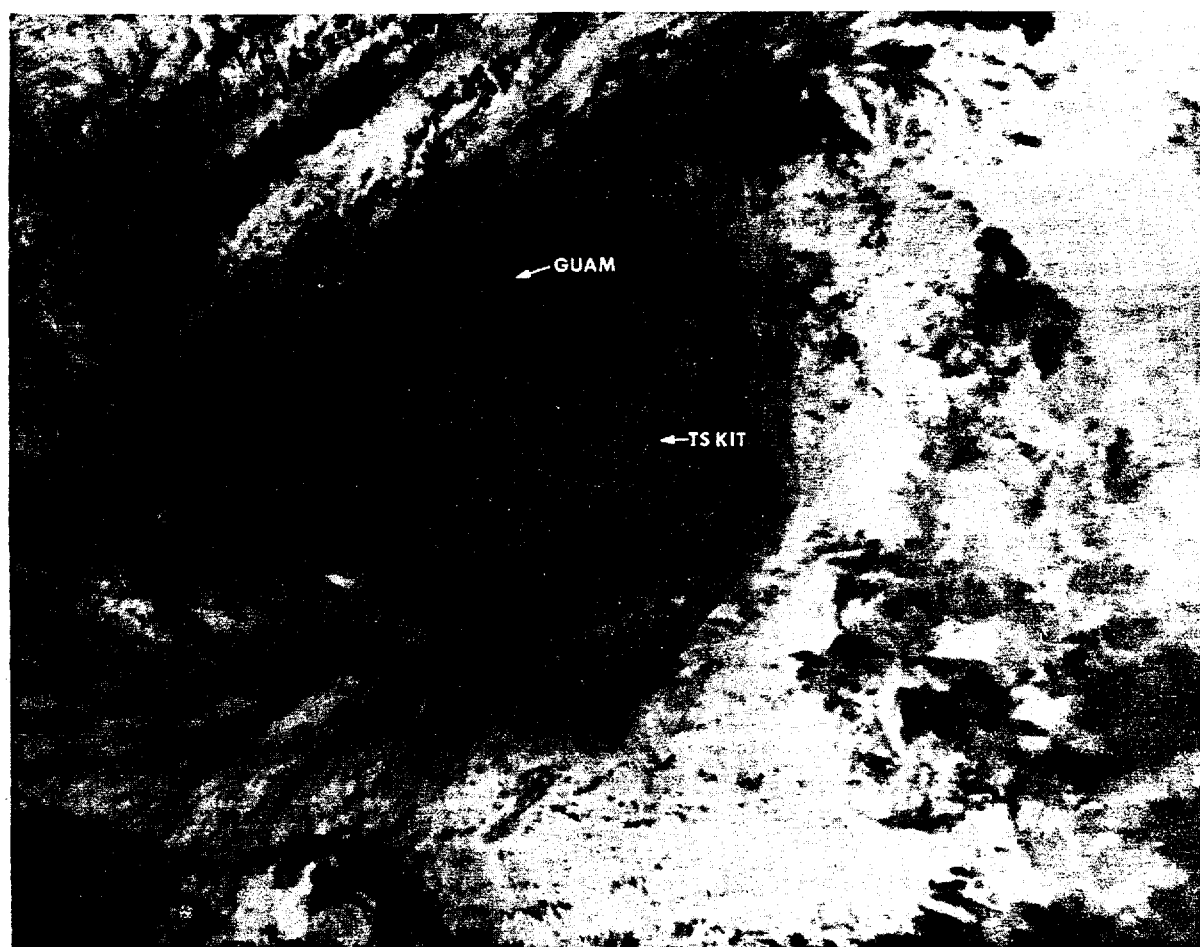


Figure 3-28-3. Infrared imagery which shows Tropical Storm Kit's large convective mass, however, the lighter grey shades on the eastern side show lower cloud features. Utilizing these data, Det 1, 1WW satellite analysts provided accurate fixes during a lengthy period without aircraft fixes, 121003Z December. (NOAA 6 infrared imagery)

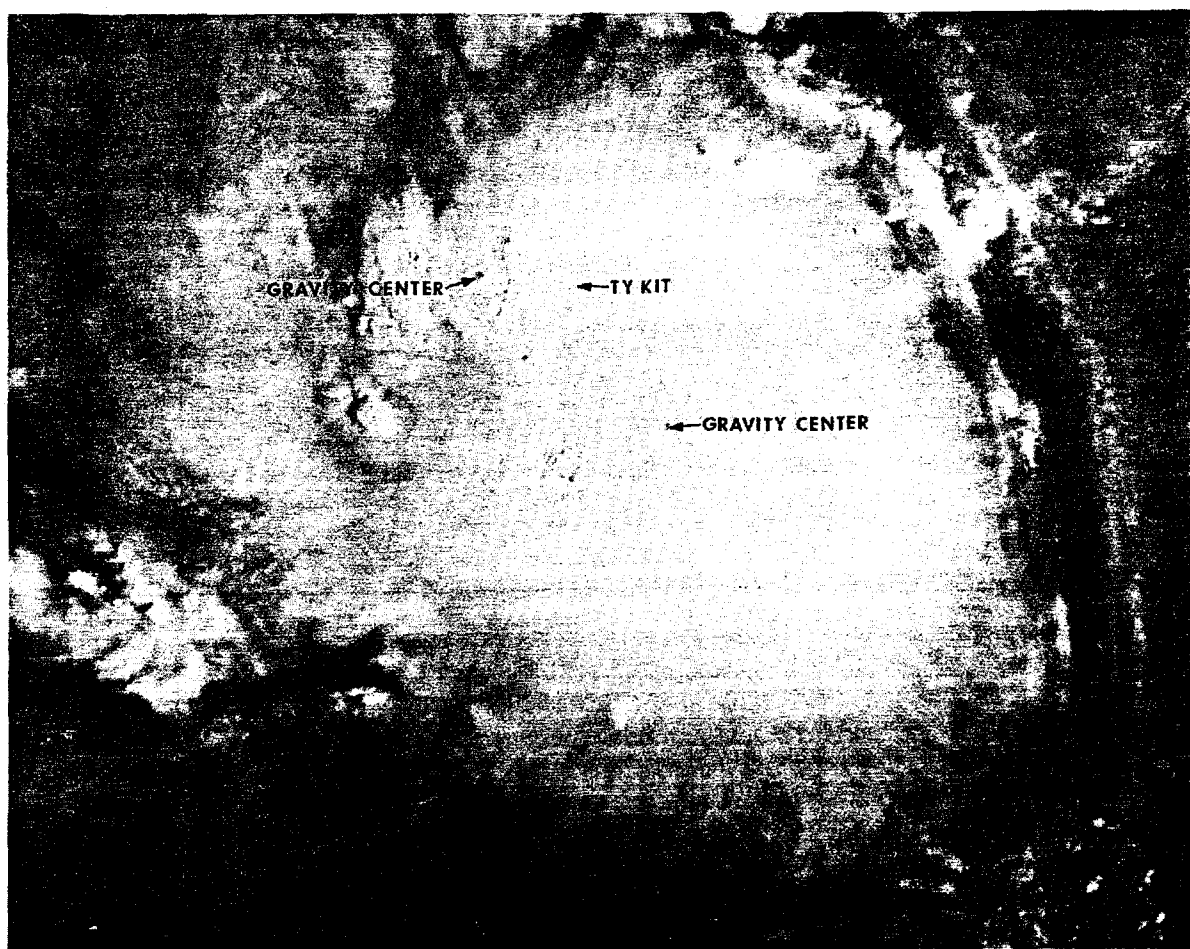


Figure 3-28-4. An intensifying Typhoon Kit, located 165 nm (306 km) west of Guam. Note the textured cloud pattern. Often referred to as gravity waves, these features are frequently seen in rapidly developing tropical cyclones prior to the development of an eye. About 14 hours later, Kit's eye was first detected, 132219Z December. (NOAA 6 visual imagery)

intensification, Kit turned sharply northward and once again slowed to a speed of movement of 4 kt (7 km/hr). Kit's northward movement presented JTWC forecasters with a major dilemma. From the very first warning, Kit was thought to be an eventual westward mover. The strength of the low-level northeast surge originating over Asia had previously dictated the tracks of Hazen (25), Irma (26) and Jeff (27). There had been no appreciable change in the mid-latitude wind regime since those tropical cyclones, thus, a similar scenario seemed very appropriate. But Kit's movement was seemingly in defiance to the synoptic situation. When the 142005Z reconnaissance aircraft data located Kit at 14.3N, the 141800Z warning was amended to show recurvature. However, at 150000Z, the synoptic data showed renewed strength in the northeast surge (Fig. 3-28-5) and accordingly, near 151200Z, Kit turned westward once again. At 161200Z the forecast that abandoned the concept of eventual recurvature was issued.

With hindsight it is fair to say that virtually all the ingredients were present to allow Kit to recurve, except one. The effect of the low-level flow could not be overcome, and despite the presence of a mid-latitude trough just north of Kit, there was a limit to her northward movement.

Following the resumption of a westerly track, Kit began to reintensify as she moved into a position that allowed strong upper-level westerlies to provide an excellent outflow channel to the northeast (Fig. 3-28-6). At 170830Z, a reconnaissance aircraft measured a 924 mb central pressure, or approximately 115 kt (59 m/sec) maximum winds based upon the Atkinson and Holliday (1977) pressure/intensity curve. During the next two days, as Kit began interacting with stronger mid-tropospheric westerlies, she steadily weakened and by 191800Z, had lost typhoon force winds. On 18 December, Kit

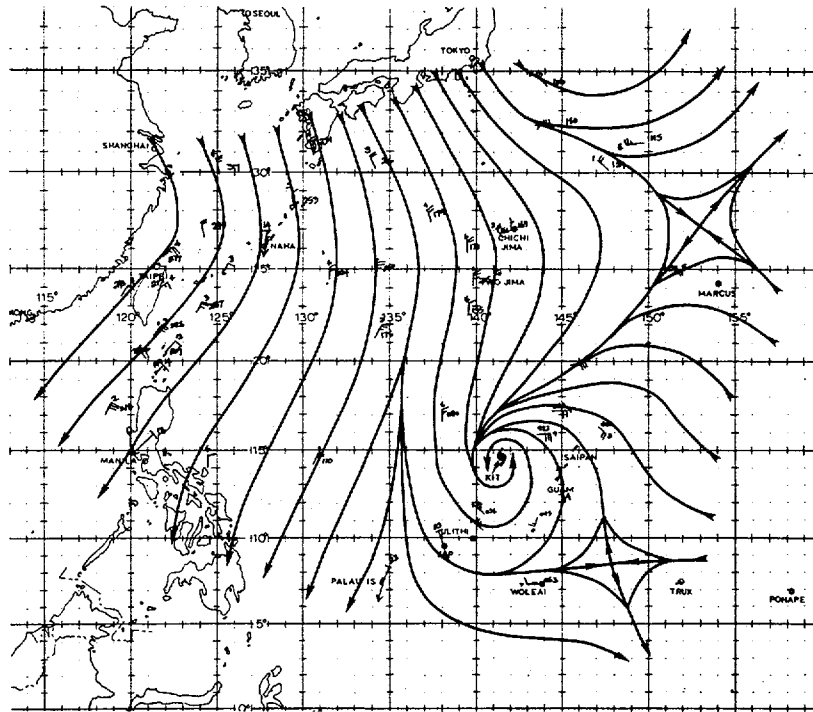


Figure 3-28-5. Surface and gradient level data at 150000Z December with streamline analysis showing a new surge of high pressure moving off of northeastern China. During the following 12 hour period, this surge effectively closed-off any potential for Kit to recurve and once again forced her on a westward track.

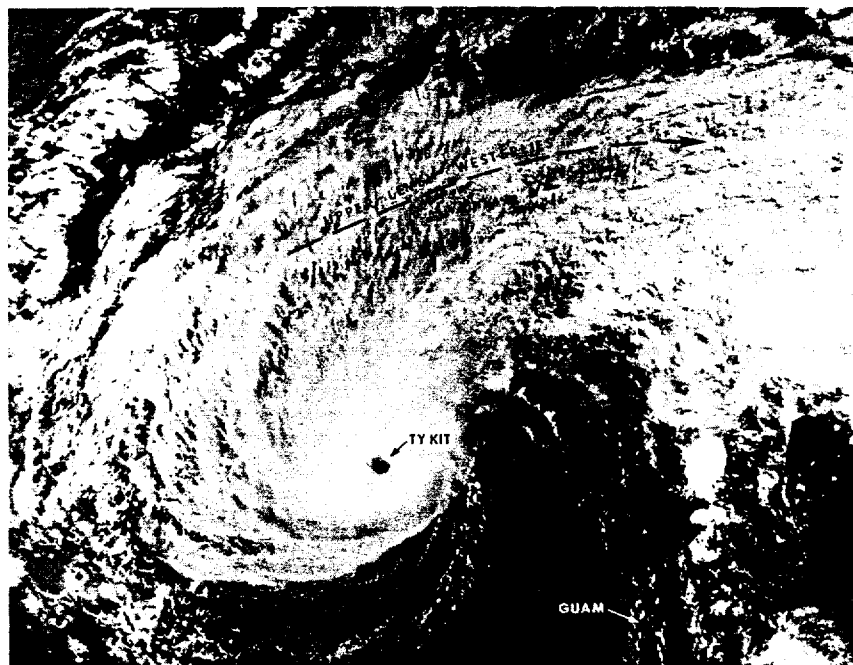


Figure 3-28-6. Typhoon Kit near peak intensity (115 kt [59 m/sec]). Virtually all of Kit's outflow is into the upper-level westerlies. This is the most common pattern for late season typhoons at higher latitudes, 170502Z December. (NOAA 7 visual imagery)

was once again in position where, because of the presence of a deepening trough over eastern China and a break in the northeast surge, she might again jog north and possibly recurve. Thus, from 180600Z to 191800Z, the forecasts showed an increasing tendency for a track toward recurvature near 125E. However, by 200000Z, it became obvious that Kit's low-level circulation had failed to link-up with the approaching shortwave trough and the track toward recurvature was once again abandoned. It was about this time, that aircraft and satellite data began showing Kit's low-level circulation center emerging on the southern edge of the main convective mass. Within hours, Kit's mid- and upper-level features weakened and began drifting northward into the shortwave trough. The low-level center, now fully exposed,

turned southward under the influence of low-level northerlies which followed the short-wave trough off of China. At 200743Z, a reconnaissance aircraft located Kit's low-level center 110 nm (204 km) south of the 200000Z warning position. The 200743Z aircraft, as well as 200520Z satellite imagery (Fig. 3-28-7), showed Kit's entire circulation pattern enveloped in a heavy stratocumulus cloud deck. Later infrared imagery could not identify the circulation center, but at 202157Z, the final reconnaissance aircraft mission located a weak low-level center near 13N 129E. Downgraded to Tropical Depression 28 at 201800Z, the fortieth and final warning was issued at 210000Z. During the 36 hours which followed, a weak low-level center could be identified moving southwestward into Mindanao, Republic of the Philippines.



Figure 3-28-7. A weakening Tropical Storm Kit, with the low-level center moving southward while the remnants of her convection move northeastward into a shortwave trough. Note the hyper-extended circulation pattern. The low-level steering was literally stretching Kit southward with time, 200609Z December. (NOAA 7 visual imagery)